KA78LXXA/KA78L05AA

3-Terminal 0.1A Positive Voltage Regulator

Features

- Maximum Output Current of 100mA
- Output Voltage of 5V, 6V, 8V, 9V,10V, 12V, 15V, 18V and 24V
- Thermal Overload Protection
- Short Circuit Current Limiting
- Output Voltage Offered in ± 5% Tolerance

Description

The KA78LXXA/KA78L05AA series of fixed voltage monolithic integrated circuit voltage regulators are suitable for application that required supply current up to 100mA.

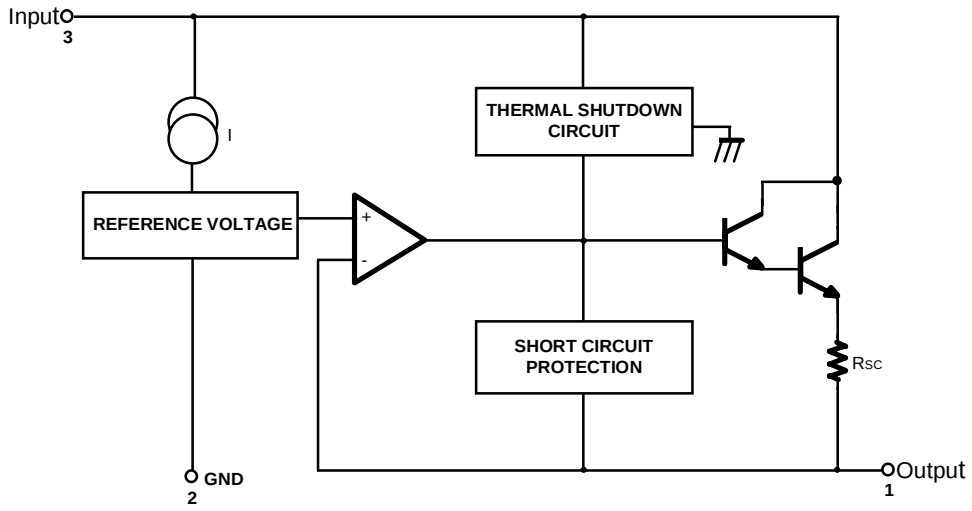
TO-92 **SOT-89**

1. Output 2. GND 3. Input

8-SOP

1. Output 2. GND 3. GND 4. NC
5. NC 6. GND 7. GND 8. Input

Internal Block Diagram



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Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for V_O = 5V, 8V) (for V_O = 12V to 18V) (for V_O = 24V	V_I	30 35 40	V V V
Operating Junction Temperature Range	T_J	0 ~ +150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Electrical Characteristics(KA78L05A)

(V_I = 10V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		4.8	5.0	5.2	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	7V ≤ V_I ≤ 20V	-	8	150	mV
				8V ≤ V_I ≤ 20V	-	6	100	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA	-	11	60	mV
				1mA ≤ I_O ≤ 40mA	-	5.0	30	mV
Output Voltage		V_O	7V ≤V_I ≤20V	1mA ≤ I_O ≤ 40mA	-	-	5.25	V
			7V ≤V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	4.75	-	5.25	V
Quiescent Current		I_Q	T_J = 25 °C		-	2.0	5.5	mA
Quiescent Current Change	with line	ΔI_Q	8V ≤V_I ≤ 20V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40 mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz		-	40	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	-0.65	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 8V ≤ V_I ≤ 18V, T_J = 25 °C		41	80	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Note:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Electrical Characteristics(KA78L06A)

(V_I = 12V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		5.75	6.0	6.25	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	8.5V ≤ V_I ≤ 20V	-	64	175	mV
				9V ≤ V_I ≤ 20V	-	54	125	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA	-	12.8	80	mV
				1mA ≤ I_O ≤ 70mA	-	5.8	40	mV
Output Voltage		V_O	8.5 ≤ V_I ≤ 20V, 1mA ≤ I_O ≤ 40mA		5.7	-	6.3	V
			8.5 ≤ V_I ≤ V_{MAX}(Note), 1mA ≤ I_O ≤ 70mA		5.7	-	6.3	V
Quiescent Current		I_Q	T_J = 25 °C		-	-	5.5	mA
			T_J = 125 °C		-	3.9	6.0	mA
Quiescent Current Change	with line	ΔI_Q	9 ≤ V_I ≤ 20V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz		-	40	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	0.75	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 10V ≤ V_I ≤ 20V, T_J = 25 °C		40	46	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Note:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Electrical Characteristics(KA78L08A)

(V_I = 14V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		7.7	8.0	8.3	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	10.5V ≤ V_I ≤ 23V	-	10	175	mV
				11V ≤ V_I ≤ 23V	-	8	125	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA	-	15	80	mV
				1mA ≤ I_O ≤ 40mA	-	8.0	40	mV
Output Voltage		V_O	10.5V ≤ V_I ≤ 23V	1mA ≤ I_O ≤ 40mA	7.6	-	8.4	V
			10.5V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	7.6	-	8.4	V
Quiescent Current		I_Q	T_J = 25 °C		-	2.0	5.5	mA
Quiescent Current Change	with line	ΔI_Q	11V ≤ V_I ≤ 23V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤100KHz		-	60	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	-0.8	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 11V ≤ V_I ≤ 21V, T_J = 25 °C		39	70	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Note:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Electrical Characteristics(KA78L09A)

(V_I = 15V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		8.64	9.0	9.36	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	11.5V ≤ V_I ≤ 24V	-	90	200	mV
				13V ≤ V_I ≤ 24V	-	100	150	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA	-	20	90	mV
				1mA ≤ I_O ≤ 40mA	-	10	45	mV
Output Voltage		V_O	11.5V ≤ V_I ≤ 24V	1mA ≤ I_O ≤ 40mA	8.55	-	9.45	V
			11.5V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	8.55	-	9.45	V
Quiescent Current		I_Q	T_J = 25 °C		-	2.1	6.0	mA
Quiescent Current Change	with line	ΔI_Q	13V ≤ V_I ≤ 24V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz		-	70	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	-0.9	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 12V ≤ V_I ≤ 22V, T_J = 25 °C		38	44	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Note:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Electrical Characteristics(KA78L10A)

(V_I = 16V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		9.6	10.0	10.4	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	12.5 ≤ V_I ≤ 25V	-	100	220	mV
				14V ≤ V_I ≤ 25V	-	100	170	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA	-	20	94	mV
				1mA ≤ I_O ≤ 70mA	-	10	47	mV
Output Voltage		V_O	12.5V ≤ V_I ≤ 25V, 1mA ≤ I_O ≤ 40mA		9.5	-	10.5	V
			12.5V ≤ V_I ≤ V_{MAX} (Note2) 1mA ≤ I_O ≤ 70mA		9.5	-	10.5	
Quiescent Current		I_Q	T_J = 25 °C		-	-	6.0	mA
			T_J =125 °C		-	4.2	6.5	
Quiescent Current Change	with line	ΔI_Q	12.5 ≤ V_I ≤ 25V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz		-	74	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	0.95	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 15V ≤ V_I ≤ 25V, T_J = 25 °C		38	43	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Electrical Characteristics(KA78L12A)

(V_I = 19V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		11.5	12	12.5	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	14.5V ≤ V_I ≤ 27V	-	20	250	mV
				16V ≤ V_I ≤ 27V	-	15	200	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA	-	20	100	mV
				1mA ≤ I_O ≤ 40mA	-	10	50	mV
Output Voltage		V_O	14.5V ≤ V_I ≤ 27V	1mA ≤ I_O ≤ 40mA	11.4	-	12.6	V
			14.5V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	11.4	-	12.6	V
Quiescent Current		I_Q	T_J = 25 °C		-	2.1	6.0	mA
Quiescent Current Change	with line	ΔI_Q	16V ≤ V_I ≤ 27V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz		-	80	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	-1.0	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 15V ≤ V_I ≤ 25V, T_J = 25 °C		37	65	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Note:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Electrical Characteristics(KA78L15A)

(V_I = 23V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		14.4	15	15.6	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	17.5V ≤ V_I ≤ 30V	-	25	300	mV
				20V ≤ V_I ≤ 30V	-	20	250	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA	-	25	150	mV
				1mA ≤ I_O ≤ 40mA	-	12	75	mV
Output Voltage		V_O	17.5V ≤ V_I ≤ 30V	1mA ≤ I_O ≤ 40mA	14.25	-	15.75	V
			17.5V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	14.25	-	15.75	V
Quiescent Current		I_Q	T_J = 25 °C		-	2.1	6.0	mA
Quiescent Current Change	with line	ΔI_Q	20V ≤ V_I ≤ 30V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz		-	90	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	-1.3	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 18.5V ≤ V_I ≤ 28.5V, T_J = 25 °C		34	60	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Note:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Electrical Characteristics(KA78L18A)

(V_I = 27V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		17.3	18	18.7	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	21V ≤ V_I ≤ 33V	-	145	300	mV
				22V ≤ V_I ≤ 33V	-	135	250	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O≤100mA	-	30	170	mV
				1mA ≤ I_O ≤ 40mA	-	15	85	mV
Output Voltage		V_O	21V ≤ V_I ≤ 33V	1mA ≤ I_O ≤ 40mA	17.1	-	18.9	V
			21V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	17.1	-	18.9	V
Quiescent Current		I_Q	T_J = 25 °C		-	2.2	6.0	mA
Quiescent Current Change	with line	ΔI_Q	21V ≤ V_I ≤ 33V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz		-	150	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	-1.8	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 23V ≤ V_I ≤ 33V, T_J = 25 °C		34	48	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Note:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Electrical Characteristics(KA78L24A)

(V_I = 33V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		23	24	25	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	27V ≤ V_I ≤ 38V	-	160	300	mV
				28V ≤ V_I ≤ 38V	-	150	250	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA	-	40	200	mV
				1mA ≤ I_O ≤ 40mA	-	20	100	mV
Output Voltage		V_O	27V ≤ V_I ≤ 38V	1mA ≤ I_O ≤ 40mA	22.8	-	25.2	V
			27V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	22.8	-	25.2	V
Quiescent Current		I_Q	T_J = 25 °C		-	2.2	6.0	mA
Quiescent Current Change	with line	ΔI_Q	28V ≤ V_I ≤ 38V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz		-	200	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	-2.0	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 28V ≤ V_I ≤ 38V, T_J = 25 °C		34	45	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Note:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for V_O = 5V, 8V) (for V_O = 12V to 18V) (for V_O = 24V	V_I	30 35 40	V V V
Operating Junction Temperature Range	T_J	0 ~ +150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Electrical Characteristics(KA78L05AA)

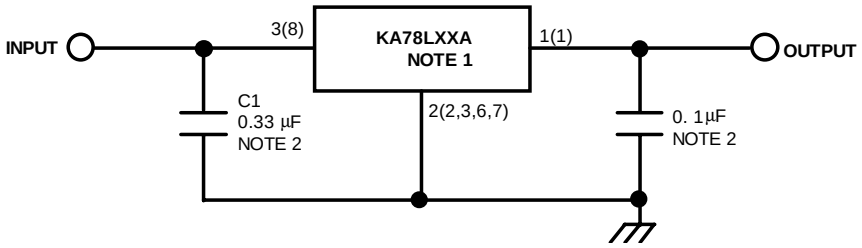
(V_I = 10V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Parameter		Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage		V_O	T_J = 25 °C		4.9	5.0	5.1	V
Line Regulation (Note1)		ΔV_O	T_J = 25 °C	7V ≤ V_I ≤ 20V	-	8	150	mV
				8V ≤ V_I ≤ 20V	-	6	100	mV
Load Regulation (Note1)		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA	-	11	50	mV
				1mA ≤ I_O ≤ 40mA	-	5.0	25	mV
Output Voltage		V_O	7V ≤V_I ≤20V	1mA ≤ I_O ≤ 40mA	-	-	5.15	V
			7V ≤V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	4.85	-	5.15	V
Quiescent Current		I_Q	T_J = 25 °C		-	2.0	5.5	mA
Quiescent Current Change	with line	ΔI_Q	8V ≤V_I ≤ 20V		-	-	1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40 mA		-	-	0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz		-	40	-	μV/Vo
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA		-	-0.65	-	mV/ °C
Ripple Rejection		RR	f = 120Hz, 8V ≤ V_I ≤ 18V, T_J = 25 °C		41	80	-	dB
Dropout Voltage		V_D	T_J = 25 °C		-	1.7	-	V

Note:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation P_D ≤ 0.75W.

Typical Application



’( )’ : 8SOP Type

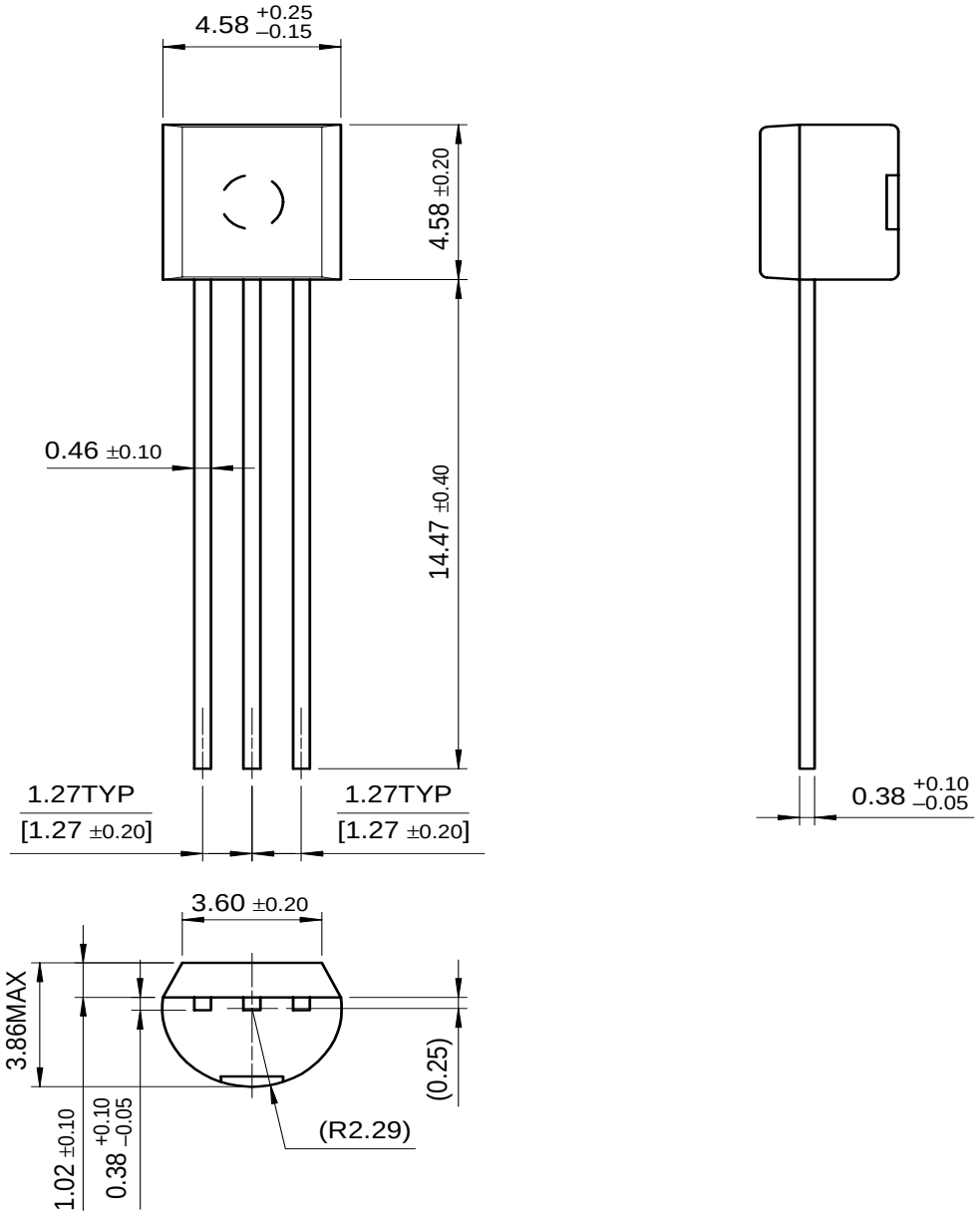
Notes:

1. To specify an output voltage, substitute voltage value for “XX”.
2. Bypass Capacitors are recommend for optimum stability and transient response and should be located as close as possible to the regulator

Mechanical Dimensions

Package

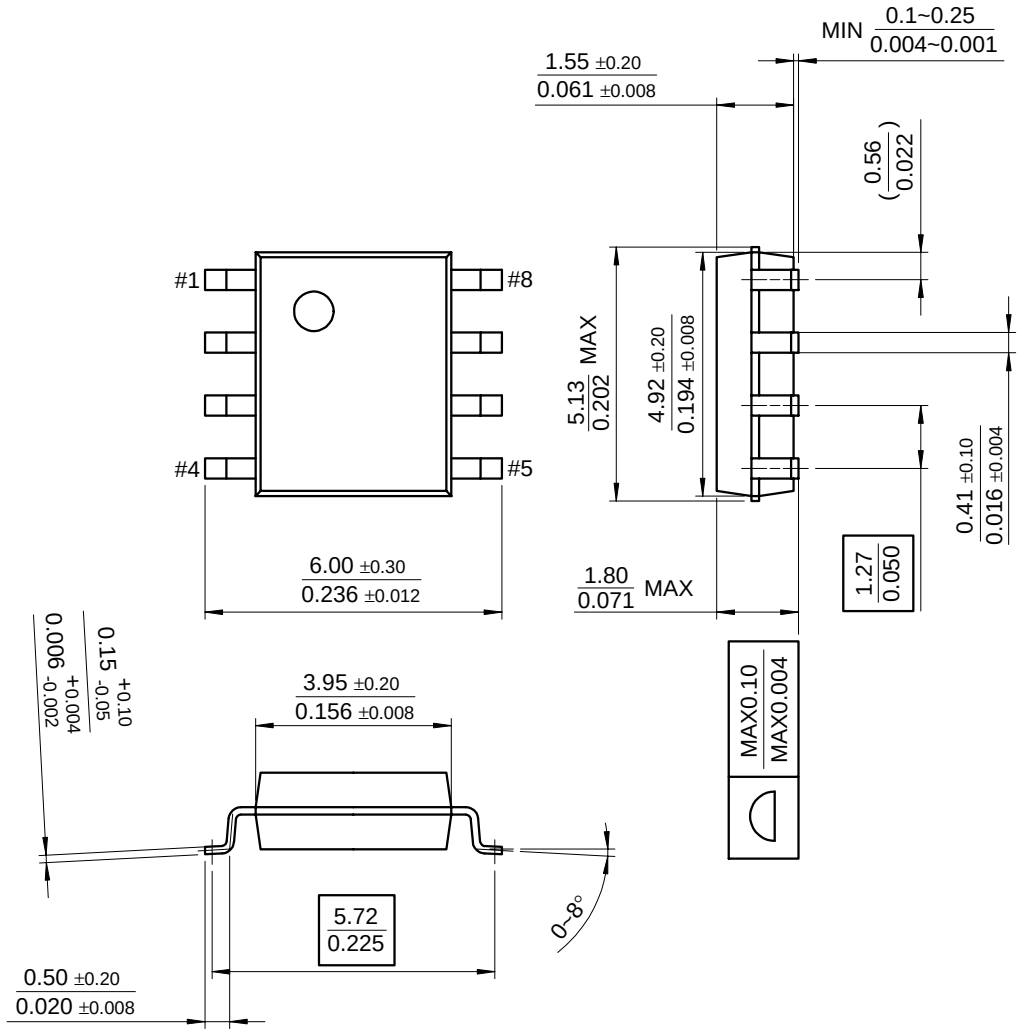
TO-92



Mechanical Dimensions(Continued)

Package

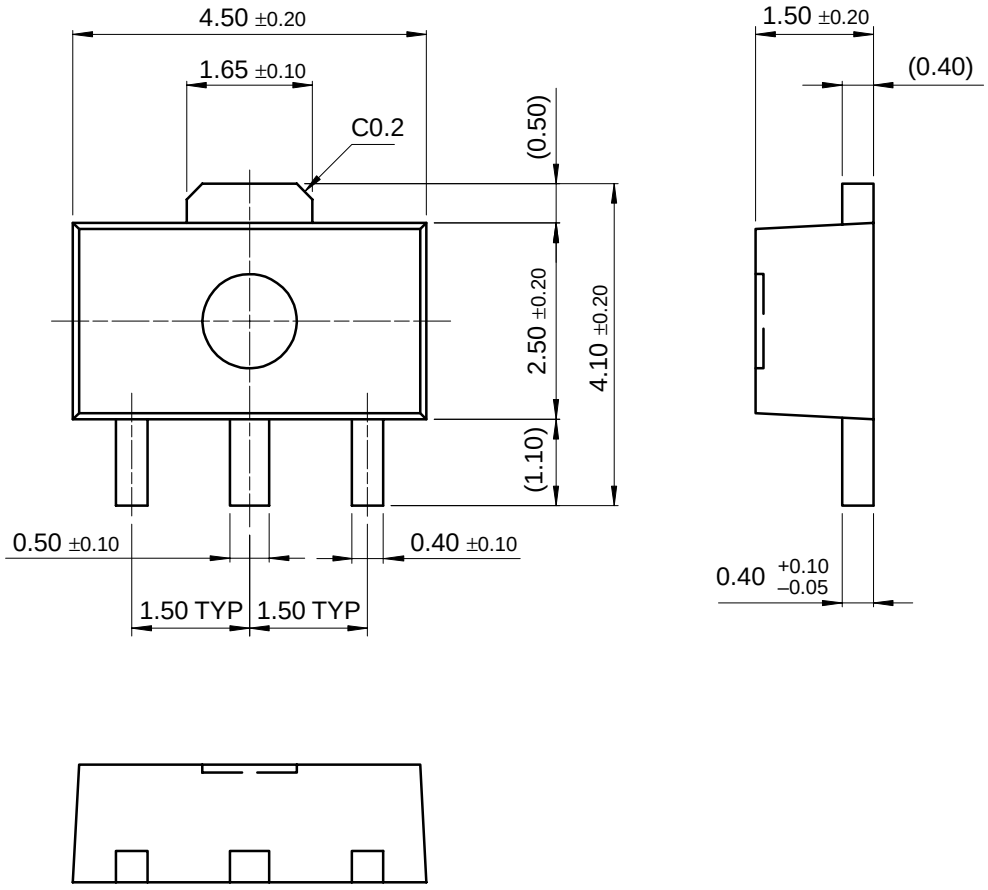
8-SOP



Mechanical Dimensions (Continued)

Package

SOT-89



Ordering Information

Product Number	Package	Output Voltage Tolerance	Operating Temperature
KA78L05AZ	TO-92	5%	0 ~ + 125 °C
KA78L06AZ			
KA78L08AZ			
KA78L09AZ			
KA78L10AZ			
KA78L12AZ			
KA78L15AZ			
KA78L18AZ			
KA78L24AZ			
KA78L05AD	8-SOP		
KA78L08AD			
KA78L12AD			
KA78L05AM	SOT-89		
KA78L08AM			
KA78L12AM			
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